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AUTHOR Coley, Betty A.
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ABSTRACT

This paper reviews the current literature on the preservation of library materials and develops an overview of the state-of-the-art for conservation programs. The 13 references provided are concerned with the preservation of book materials, the design of processes and facilities to prevent or retard deterioration, development of disaster planning, salvaging of damaged materials, and preparation of conservation policy statements. A pamphlet and two leaflets form the Library of Congress are attached. (RAA)

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PLANNING AND DEVELOPMENT OF A CONSERVATION FACILITY

BY
BETTY A. COLEY

DENTON, TEXAS
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PLANNING AND DEVELOPMENT OF A CONSERVATION FACILITY

At the moment a work of art, a book or similar object is created, deterioration begins. All materials age with time, of course, but it is not this kind of change that concerns keepers of rare books and manuscripts, curators of paintings, textiles and other museum-related items. The object's environment, however, can be controlled to slow this aging process. On the other hand, the environment may be the culprit in speeding up the damage, especially if there is an increasing amount of chemical pollutants in the air, great variation in the temperature--humidity cycling, or excessive exposure to unfiltered light.

For the preservation and protection of cultural objects, appropriate facilities must be available for carrying out the cleaning, consolidation, and other treatment procedures that may be necessary to conserve the property. There are guidelines that should be followed for setting up any treatment area. Not only the "occupancy" space of the object should be considered but also the space requirements for the actual procedures. Another thing to consider is whether or not a "clean" area will be needed. In a paper treatment facility, the segregation of the framing area from the cleaning operation is obviously desirable.

There are some very specific considerations in the article in Technology and Conservation, Fall 1979, by Susan E. Schur and Norman R. Weiss, "Establishing Laboratories for Treatment of Cultural Properties: Guidelines for Design and Equipping of Facilities." A paper treatment laboratory needs to be equipped with sinks large enough to immerse objects needing washing, a good supply of pure water, hot plate, immersion heater, pH meter, low power microscope, and refrigerator. These are the basic tools of the trade for any cleaning and repair facility for works of art on paper.[1]

To quote Edwin E. Williams in "Deterioration of Library Collections Today," "Everything in library collections is deteriorating today, was deteriorating yesterday and will continue to deteriorate tomorrow although we ought to retard the process."[2]

John Murray wrote in The Gentleman's Magazine in July 1823,

> Allow me to call the attention of your readers to the present state of that wretched compound called Paper. Every printer will corroborate my testimony; and I am only astonished that the interesting question has been so long neglected and forgotten. It is a duty, however, of the most imperative description;-- our beautiful Religion, our Literature, our Science, all are threatened.
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> . . . I have in my possession a large copy of the

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[1]Norman R. Weiss and Susan E. Schur, "Establishing Conservation Laboratories: Planning and Equipping Facilities for Analysis and Research," Technology and Conservation, Summer 1978, pp. 16-20.

[2]Edwin E. Williams, "Deterioration of Library Collections Today," in Library Conservation: Preservation in Perspective, ed. John P. Baker and Marguerite C. Soroka (Stroudburg, Pennsylvania: Dowden, Hutchinson and Ross, Inc., 1978), pp. 3-17.

> Bible printed at Oxford, 1816 (never used), and issued by the British and Foreign Bible Society, crumbling literally into dust. I transmitted specimens of this volume to the Lord Bishop of Gloucester, and to Mr. Wilberforce. No doubt it must be difficult to legislate on such a subject, but something must be done and that early. I have watched for some years the progress of the evil, and have no hesitation in saying, that if the same ratio of progression is maintained, a century more will not witness the volumes printed within the last twenty years. MS. Records are in the same fatal condition. (4:21-22).[3]

Murray's observations and remarks have a very modern sound. He followed up his article with two monographs but unfortunately was able to enlist no support. However, the closing decade of the nineteenth century produced a number of contributions on the subject. In 1901 the International Library Congress in Paris produced a paper by Pierre Dauze who observed, "relatively recent works have completely disappeared from circulation or become more rare than incunabula." He goes on to recommend that governments buy only books on paper which meet standards approved by official laboratories.[4] In 1907 Cyril Davenport wrote that "there is no doubt that the large majority of our modern books will not be in readable condition in about a hundred years' time from the date of their publishing."[5]

In the last decade significant progress has been made in devising remedies for a solution to the problem. An ever-increasing amount of literature on this subject is emerging from public and private research laboratories in Europe and America. Library Conservation is emerging as a distinct

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[3]Ibid, p. 8.

[4]Ibid, p. 9.

[5]Ibid.

discipline closely affiliated with paper technology, the science of chemistry and physics and other fields of conservation. But as in any new field, statements and aims are often divergent, and solutions are occasionally incomplete or even contradictory. Custodians of books and records must be familiar with the literature.

We live in an era of bad paper, an era which began, as we have learned, more than a century ago with the development of wood pulp paper and the discovery and use of alum/rosin sizing. Unfortunately, this era shows little sign of ending, for although we know how to make long-lasting paper from wood pulp, we are not doing so. In fact, the paper being used in books today is, on the average, worse than paper used twenty years ago. Rather than improving, the situation grows worse and the next generation of librarians will face more serious problems than those we face today.

The late William J. Barrow in 1959 made a study of non-fiction books printed between 1900 and 1939, and concluded that 97 per cent of all books published during that time had less than a 50 year useful life span. It is sobering to realize that 97 per cent of the non-fiction books published during that forty-year span have deteriorated to the point that they are unusable at this time.[6]

It seems sad to realize, unlike the premise in Fahrenheit

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[6]Randolph W. Church, ed., Deterioration of Book Stock: Causes and Remedies: Two Studies on the Permanence of Book Paper, Virginia State Library Publication, no. 10, conducted by W. J. Barrow (Richmond: Virginia State Library, 1959).

451, a 1966 motion picture, in which books had to be memorized to be retained for political reasons, that because of our lack of action this premise may become a reality, not in the far-distant future but now! It has been estimated that eighty percent of the books in special collections and research libraries are in need of some attention. Each passing day thousands of volumes are added to the critical list, even though many have not been moved from their places on the shelves for years. It seems far more important at the moment to arrest this progressive deterioration than to restore those that have become unusable.

The cause for deterioration has been isolated into three main categories--biological, physiochemical, and mechanical. It is now known that the causes in any category may act independently or concurrently on materials, but their effects are always closely dependent on each other. Laboratory researchers regard our problem from the points of view of research and development vs. treatment; conservators regard library conservation in two different categories--preventive measures and restoration. A third category is the development of permanence in materials.[7] Preventive conservation is the logical point of departure for a program of total conservation which will include all of the measures necessary to preserve our heritage. A conservation program must include scholarly knowledge, craftsmen's skills and technological experience. Only by cooperation between custodians, scientists, conservators and restorers will

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[7]Howard P. Lowell, "Conserving Library Collections," PNLA Quarterly, Fall 1977, pp. 15-17.

it be possible to provide long life for library materials. This must be a continuing process getting its full share of time and budget. Libraries stuggle for funds to purchase materials; large investments are made to catalog and make them accessible and usable. But all too often these materials are put on shelves in buildings without environmental controls where they suffer from extremes of temperature and humidity and also suffer abrasion from dust and particle matter. These materials, originally issued on poor paper, (and much of the paper used for printing since the 19th century can be aptly described) are disintegrating rapidly. "Book dandruff",[8] as one of the more poetic librarians has called it, can be seen any day covering the floor of library stacks and reading rooms. There are many reasons for this. Often it is impossible to recognize at what point a book should be treated or to know whether it is worth preserving. Yet it could be said of most research materials--if they are worth acquiring and processing, surely they are worth preserving. Librarians and others have been concerned about this problem for over a century but due to the lack of a method of mass treatment of materials, a dearth of qualified book conservators and not enough knowledge of the book conservation field as a professional discipline--activity among librarians and book conservators has been increasingly strong in the last decade. Conservation departments have been established at a few major research libraries.

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[8]John P. Baker and Marguerite C. Soroka, Library Conservation: Preservation in Perspective (Stroudburg, Pennsylvania: Dowden, Hutchinson and Ross, Inc., 1978),

The benefits of air-conditioning systems and the most meticulous attention to housekeeping will be to little avail if the containers, shelving and cabinetry for library materials are not well designed. The importance of scientific design of book stacks for new construction and the renovation of old buildings, have been well covered by several experts in the field, including Keyes D. Metcalf's discussion of the relation between building design and book preservation in Restaurator.[9]

In George and Dorothy Cunha's two volume work, Conservation of Library Materials, second edition, can be found extensive information on all the areas of care of materials. Volume two of this work includes a list of supplies and companies where supplies may be obtained.[10]

An excellent policy statement has been published by the University of Illinois Graduate School of Library Science in its Occasional Papers, number 139, July 1979. In an article by Carolyn Clark Morrow, "A Conservation Policy Statement for Research Libraries," the following priorities are listed:

1. Stop destructive practices in the library.
2. Install environmental controls in the general stacks and departmental libraries, including systems for filtration of particulate matter and absorption of gaseous pollutants, air-conditioning, humidity control, and protection against the effects of ultraviolet rays.
3. Educate the library staff to recognize items needing treatment and to cease thoughtless practices.

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[9]Keyes D. Metcalf, "The Design of Book Stacks and the Preservation of Books," Restaurator 1 (1969):115-25.

[10]George Daniel Martin Cunha and Dorothy Grant Cunha, Conservation of Library Materials, 2nd ed., 2 vols. (Metuchen, N.J.: Scarecrow Press, Inc., 1972).

4. Identify and isolate those materials in immediate danger.
5. Isolate items too brittle to circulate.
6. Implement broad policies for the conservation of the collections.
7. Formulate specific objectives based on the policies and goals of the conservation program.
8. Assign priorities to items needing treatment and develop procedures for treatment.[11]

Until recently conservation has not been taught in library schools. As a result, it is not within the scope of most librarians to be knowledgeable about the conservation of library materials. One of the most important things to be aware of is the limited knowledge most librarians have in actual laboratory practice of the deacidification of materials. If this is to be attempted in-house, care must be exercised in what is undertaken. In the article in AB Bookman, June 6, 1977, the kitchen chemistry technique is explored and good advice for its implementation given. If funds are available, the best choice would be the services, part or full time of a qualified and experienced conservator. The first and logical choice would be to have this performed in a facility on the premises. Failing the practicality of that, the next choice would be to send the materials to be treated to a well-established and proven conservation center.

An important consideration is the potential of regional centers. The first and at this time, still the only regional conservation center is the one in New England, set up by George Cunha and now aptly administered by Ann Russell. Within two

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[11] Carolyn Clark Morrow, "A Conservation Policy Statement for Research Libraries," Occasional Papers, University of Illinois, Graduate School of Library Science, number 139 (July 1979): 4.

years this center became self-supporting. Mr. Cunha stands ready and available to help any area interested in setting up a regional center in its area. Rumors have the movement for such facilities in The Rocky Mountain area, Texas and California. As recently as November, 1980 a meeting was held at the Texas State Library in Austin, Texas to survey the need for such a facility. It was learned that several institutions represented were already underway with plans for in-house conservation laboratories. Some of these, such as one at Dallas Public Library are already operating. The Panhandle-Plains Museum in Canyon under the guidance of a businessman turned museum director, seems to have a good chance of actually being established in the near future. The services of a conservator have already been secured and some work has been on-going. A prospectus to implement such a regional center in the Canyon area had been prepared, with funding to come from state and private sources. The suggestion was made that several such centers would be needed for an area as large as Texas. It is believed that in less than five years, there will be such facilities in Austin, Waco, Dallas and Houston, besides the Canyon center.

Paul N. Banks, Conservator at the Newberry Library and president of the American Institute for Conservation of Historic and Artistic Works, defined the three different types of personnel needed for a physical preservation program: the administrator, a librarian with enough technical background to establish priorities and policies to guide day-to-day selection and treatment procedures; the conservator, a skilled professional responsible for final treatment decisions often involving

testing of materials, for training staff and insuring quality control, and for performing complex treatment procedures; and the conservation technician, carrying out "routine" treatments under the supervision of the conservator.[12]

Administration of a comprehensive conservation program including installation and monitoring of air-conditioning and humidity control systems; appropriate facilities for in-house repair, rebinding and preservation microfilming; and maintenance of a cleaning and inspection schedule requires large expenditures of money. Initial costs are not the only concern of a research library; costs for conservation treatment or preventative measures must be expressed in terms of long range retention of materials or permanent research value. Short of a comprehensive conservation program there is much that can be done to preserve library materials. A comprehensive program may be economically or philosophically unfeasible; however, every library can develop a policy for conservation that consists of sensible rules for the storage and handling of library materials, stiff requirements for the contracting of commercial binding and preservation microfilming, and provisions for an efficient, nondestructive in-house repair facility. Such a policy is inexpensive to initiate and would reduce the amount of senseless and costly abuse of library materials.

There is another very important consideration that should be a part of every collection and that is a disaster plan. Many

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[12]Pamela W. Darling, "National Planning in the U.S.: Meeting held at L.C., December 16-17, 1976," Restaurator 2, numbers 3-4 (1978): 205-213.

excellent articles have been written on this subject that offer suggestions that can be carried out in-house. There are also experts in this area who stand available for consultation for planning or helping with an actual disaster. The Preservation office at the Library of Congress is readily available in this area. This office publishes brochures and technical leaflets to help with the formation of a plan for each situation. Some examples of these are included for reference.

Peter Waters, Restoration Officer at the Library of Congress has written a very helpful article on this subject.

> "In such instances as flooding, water from fire-fighting; broken water pipes or other accidents resulting in severe water damage--request an on-site qualified, experienced library or archival conservator. Restoration Office at Library of Congress stands ready to serve as an information center and if need be, as a coordinating agency for emergency salvage efforts. Replacement is nearly always much less costly than restoration.[13]

Paul S. Koda's article in the Spring issue 1979 of volume 37 of North Carolina Libraries, "The Most Important First Step in a Conservation Program Is. . ." points up the necessity of having a good disaster plan. It may not be a flood of the proportion of the 1966 Florence flood but a broken water main or a sump pump that fails to operate--any cause that catches us by surprise can have devastating results. Mr. Koda strongly suggests that every library should order the following three documents:

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[13]Peter Waters, Procedures for Salvage of Water-Damaged Library Materials (Washington, D.C.: Library of Congress, 1979).

1. Bohem, Hilda. Disaster Prevention and Disaster Preparedness.

2. Martin, John. The Coming Flood: Museum Under Water.

3. Matthai, Robert. Protection of Cultural Properties During Energy Emergencies.[14]

Peter Waters, in Procedures for Salvage of Waterdamaged Library Materials, says there are three major goals in setting up an effective disaster plan: Prevention, Preparation, and Prompt Action. A library disaster team should be formed to train, retrain and practice all the time. The team should review and update the disaster plan; keep the entire library and keep people in administration informed of their activities; and engage in continuing education for themselves and for new staff members of the library. Even if it is never used, a disaster plan can be enormously beneficial by making everyone aware of the physical importance of collections. This increased sensitivity will aid in building comprehensive conservation programs which will insure that books, manuscripts and materials, which can never be replaced, will be available for students and scholars in the future.

Organizations such as the Council of Library Resources and the Association of Research Libraries are among those urging greater use of new technologies to neutralize the acid in paper.[15]

One painstaking process involves taking a book apart and

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[14]Paul S. Koda, "The Most Important First Step in a Conservation Program Is..." North Carolina Libraries 37 (Spring 1979).

[15]Waters, Procedures,

immersing the pages individually in an antacid solution, then drying the pages and rebinding them. For some volumes, this tedious procedure can cost as much as $300 per book. Another highly effective, and far less costly, method involves placing books in an airtight chamber and gassing them with a special vapor that penetrates the paper and makes it chemically neutral. Experts believe that the cost of this process can be as low as $1.00 per volume. On the cover of the Spring 1980 issue of NASA Tech Briefs, is an account of how a vacuum chamber that had been previously used by a NASA contractor to test spacecraft components is now being used in a unique deacidification process that extends the lifetime of books and other valuable documents. After drying in vacuum, the documents are exposed to a penetrating vapor of diethyl zinc, which neutralizes the life-shortening acids that are normally present in paper.[16]

A vacuum chamber has long been available from Vacudyne Corp. whose purpose has been to fumigate documents and volumes. The hope has been that the same process could be adapted to deacidify large numbers of volumes at a time and thereby cutting costs and the amount of time needed per volume to under the $1.00 per volume.

The total list price of items needed to begin operation of a paper conservation lab, as given by a conservator, is under $5000. They include: sheets of glass for press; screw press; thymol chamber; list table; trays for washing; two large tables with storage (see attached drawings); general supplies of paper,

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[16] NASA Tech Briefs 5, number 1 (Spring 1980): front cover.

blotters, glue and chemicals.

If the proposed facility to be established is to be within a university or other institution that already has analytical and research facilities, these may have the capabilities that can be called upon when necessary that will make items such as SEMs, electron probes, etc. unnecessary for purchase. Even small, minimally equipped labs can do excellent work with the right staff while an extensively equipped laboratory without the proper staff may not succeed. The basic shell for any laboratory should meet the required power, plumbing, venting and air-conditioning needs. A very good source for stocking a laboratory may be found in the Weiss and Schur article.[17]

This article is by no means intended to be definitive on this subject but to serve as a springboard to some of the literature for preservation for in the words of Frederick Locker-Lampson, "...it is a good thing to read books, and it need not be a bad thing to write them, but it is a pious thing to preserve those that have been sometime written."[18]

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[17]Weiss, Technology and Conservation, p. 18.

[18]George Martin Cunha and Norman Paul Tucker, Library and Archives Conservation, The Library of the Boston Athenaeum (Boston, Mass., 1972), p. 3.

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[1]**pre·serve** \prē′zərv, prə′-, -zəv, -zəiv\ *vb* -ED/ -ING/-S [ME *preserven,* fr. MF *preserver,* fr. ML *praeservare,* fr. LL, to observe, fr. L *prae-* pre- + *servare* to keep, guard – more at CONSERVE] *vt* **1** : to keep safe from injury, harm, or destruction : guard or defend from evil : PROTECT, SAVE **2 a** : to keep alive, intact, in existence, or from decay ⟨~ an old book⟩ **4** : to retain in one's possession **c** : MAINTAIN **3 a** : to keep or save from decomposition (as by refrigeration, curing, or treating with a preservative) ⟨~ specimens or skins to be stuffed⟩ **4** : to keep up and reserve for personal or special use **1** : to remain fresh or in its original state : KEEP **2** : to endure or stand the process of preservation

The deterioration
of millions of books
on the shelves of
American libraries
is one of the most crucial problems
facing the scholarly world today.
These books, published in the years since 1850,
have become so brittle
they can no longer be used
without risking serious damage to their texts
and ultimately destroying
the volumes themselves.
The dimensions of the problem
are enormous.
The Library of Congress
estimates that as many as one-third
of its 17 million books
are so badly deteriorated
they would be
irreparably damaged if used,
or are rapidly reaching that point.
The New York Public Library
estimates that perhaps half
of its 5 million volumes
are in an advanced stage of disintegration.
Members of the
Association of Research Libraries
report that a large number
of the more than
220 million books
in their collections
are similarly endangered.

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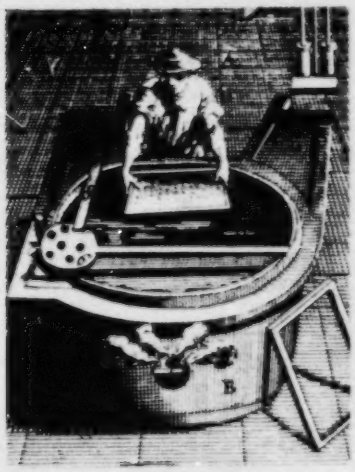
WHY BOOKS DETERIORATE

In the days when paper was made from cotton or linen rags and strengthened with gelatin sizing, it was a permanent and durable substance. Thousands of books made from rag paper have lasted for centuries and still exist in excellent condition. As printing spread and the demand for paper increased, manufacturers developed cheaper and faster ways to make paper. In the process, paper became weaker and less permanent.

Since about 1850 most book papers have been produced from wood pulp and sized with an alum and rosin compound. It is the acid component in the alum rosin sizing, combined with moisture in the atmosphere, that produces an acid which makes paper deteriorate rapidly. In addition, metallic contaminants such as iron and copper that find their way into paper during the manufacturing process hasten deterioration.

Although a few concerned librarians and scholars urged papermakers and publishers to remedy the situation, the problem of modern book papers was neglected for more than a century while thousands of books languished on library shelves. In the 1950s several studies revealed the alarming rate and extent of paper deterioration. A statistical study conducted by paper researcher William J. Barrow showed that 97 percent of the nonfiction books published between 1900 and 1939 had a useful life of only 50 years or less. "If material which should be preserved indefinitely is going to pieces as rapidly as these figures indicate," he warned, "it seems probable that most library books printed in the first half of the 20th century will be in an unusable condition in the next century."

Today the situation appears even more serious. Hundreds of thousands of new books are being printed on paper that can be expected to last only 30 or 40 years.



PRESERVING LIBRARY MATERIALS

A proper storage environment can prevent much of the deterioration of library materials. Because deterioration is a chemical reaction, paper becomes discolored and embrittled more rapidly at higher temperatures and more slowly at lower ones. On the average, the life expectancy of paper can be doubled by lowering the temperature 10° F. Air-conditioning systems designed to stabilize temperature and humidity and to filter out contaminants in the air can contribute to the longevity of library materials. While expensive, first-rate systems cannot be justified for all libraries, they are imperative for research libraries with collections of significant value.

A wide variety of conservation methods are available to preserve books, manuscripts, maps, and other library materials that are in the process of deteriorating.

Deacidification and alkaline buffering, a method devised by Barrow, slows or stops deterioration by neutralizing the acid and buffering the paper with an alkaline solution. The buffering protects the paper from future attack by acids in the air or within the paper. This process does not restore lost strength to the paper.

Polyester film encapsulation, a technique advanced at the Library of Congress, protects a brittle document by enclosing it in an envelope of polyester film. The document can be removed from the envelope easily and without damage, unlike an item treated by an earlier lamination method. Although film encapsulation was developed for individual documents such as maps, manuscripts, and prints, it also can be used to protect the embrittled leaves of books.

Leafcasting, a mechanical process, repairs documents by filling in voids and missing margins with new pulp that is compatible with the original. The process can also be used to strengthen weak and torn documents by backlining. Leafcasting may be appreciably faster than mending by hand provided the material is all of the same type.

Microfilming, unlike other methods, preserves only the intellectual content of a book. It is, however, an economical and viable preservation technique for books that have no intrinsic or artifact value.

Vapor-phase deacidification, a technique that is still being perfected, promises to lower preservation costs substantially. In this process, books and other materials are deacidified and buffered by a gas instead of a solution. The Library of Congress Preservation Research and Testing Office and the W. J. Barrow Research Laboratory in Richmond, Va., have been granted patents on vapor-phase deacidification processes, but the final tests and evaluations remain to be completed.

Phased preservation, a program recently instituted at the Library of Congress, is a practical way of decreasing the rate of deterioration until materials can be restored on an individual and more permanent basis. In effect, the program "buys" time to acquire a staff and funds to undertake complete restoration. In one project, 8,000 rare books in the Law Library were temporarily protected by housing each volume in a custom-fitted box to reduce the strain on binding and structure and by improving the storage environment. Complete restoration of this valuable collection could take 25 man-years of work.

PRESERVATION AT THE LIBRARY OF CONGRESS

The Library's preservation activities are coordinated by the Preservation Office. With a staff of 110, the office directs the preservation and restoration of the Library's vast resources, which include 18 million books and pamphlets, 32 million manuscripts, 8 million prints and photographs, and millions of maps, pieces of music, and other items. In addition, each year the Motion Picture, Broadcasting and Recorded Sound Division's Recorded Sound Section converts more than 20,000 deteriorating recordings of all types to magnetic tape and its Motion Picture Section transfers 7 to 8 million feet of deteriorating nitrate film to safety-base film. In total, the Library spends nearly $5 million annually to preserve its collections.

One of the major preservation efforts is the microfilming of millions of brittle books. Under the supervision of the Preservation Microfilming Office, the Library films nearly 200,000 pages a week, or 20,000 books a year—the equivalent of a small public library collection—at a cost of nearly half a million dollars annually. While progress is being made, the task is enormous. If microfilming were continued at the present rate, it would take 300 years and $90 million to film the estimated 5 or 6 million books that are deteriorating on the Library's shelves. By then, most of these volumes would have disintegrated and millions more would be decayed.

Binding is a traditional conservation method for protecting books and periodicals. The Binding Office oversees the binding and labeling of approximately 250,000 volumes annually at a cost of about $1 million.

Another continuing program is the conservation of thousands of valuable books, prints, manuscripts, and other materials. Under the direction of the Restoration Office, trained conservators deacidify, repair, clean, and protect damaged or deteriorating materials, devoting from one hour to several hundred hours to an item. Like microfilmers, conservators are in a race against time. The restoration of the Library's rare book collections alone, it is estimated, would consume over 5,000 man-years of effort.

Working closely with the Restoration Office, the Preservation Research and Testing Office develops and tests new methods for preserving library materials. In a well-equipped laboratory, researchers investigate problems ranging from the chemistry and physics of paper deterioration to the testing and evaluation of materials used in conservation work.

The Preservation Office staff answers inquiries relating to all aspects of library preservation, including advice on the salvage of fire and flood-damaged materials, participates in conservation seminars and workshops, provides on-site assistance in emergency situations, publishes materials on library conservation topics, and makes every effort to further the cause of conservation.

NATIONAL PRESERVATION PROGRAM

As the result of a December 1976 planning conference attended by librarians, conservators, and representatives of government agencies and private foundations, a National Preservation Program Office has been established under the auspices of the Library of Congress. Its staff is responsible for the planning, organization, development, and management of a broad-based national program for the preservation of library materials of all types.

Some of the goals for a national program, set by the planning conference, are:

- the development of a national preservation collection to preserve by low temperature storage and in their original format, both new books and those older materials that have not yet reached the final stages of deterioration and embrittlement. Materials that have reached final deterioration would be microfilmed to preserve the intellectual content. Materials in this collection would be made available to scholars through microfilm or photocopies, or by facsimile transmission.
- the establishment of an academic degree program for conservators who are needed to develop, administer, and staff the many conservation programs now being set up in research libraries.
- the development of an expanded program of preservation seminars and workshops for librarians, an enlarged publications program, traveling preservation exhibits, and a variety of other programs to further the preservation of library collections.

In accomplishing its aims, the program will need the cooperation of librarians and archivists throughout the country, as well as the support of the nation's scholars, writers, scientists, and others who rely upon the printed word.

Selected References in the Literature of Conservation

Number 1

PRESERVATION LEAFLETS

LIBRARY OF CONGRESS

This brief compilation of monographs and journals containing readings in the field of conservation is by no means comprehensive, but rather should be considered as a list of basic references for the person wishing guidance in conservation but without the need for the in-depth background required of the student of conservation or the professional conservator. This list will be updated as older items are revised or new items published. Several of the references cited here contain excellent bibliographies, and volume 2 of Cunha's Conservation of Library Materials *constitutes one of the most complete bibliographies yet published in the field of conservation. Out-of-print materials listed are available in many public or academic library collections, the rest are available through local bookstores or from the publishers.*

MONOGRAPHS

BANKS, Paul N. "Paper Cleaning," *Journal of the Guild of Book Workers* 5, fall, 1966: 8-22.

This article was one of six papers on "Paper Composition, Deterioration, Preservation" read at the annual meeting of the International Institute for Conservation of Historic and Artistic Works–American Group, held in Chicago, June 6-8, 1966. Mr. Banks discusses dry, wet, and solvent methods of cleaning paper, and the advantages and disadvantages of many of the paper-bleaching methods now in use.

W. J. Barrow Research Laboratory. *Permanence/Durability of the Book*, 7 vols., Richmond, Va., 1963-1974.

These seven small publications (the shortest contains 28 pages, the longest 116), constitute a summary of the work of W. J. Barrow, who devoted most of his life to research on the problem of paper deterioration. These volumes provide an excellent review of certain aspects of paper testing and related subjects. Individual titles in the series follow.

I. A Two-Year Research Program
II. Test Data of Naturally Aged Papers
III. Spray Deacidification
IV. Polyvinyl Acetate (PVA) Adhesives for Use in Library Bookbinding
V. Strength and Other Characteristics of Book Papers, 1800-1899
VI. Spot Testing for Unstable Modern Book and Record Papers
VII. Physical and Chemical Properties of Book Papers, 1507-1949

CLAPP, Anne F. "Curatorial Care of Works of Art on Paper," rev. ed., mimeographed, Oberlin, Ohio, Intermuseum Conservation Association, n.d. 105 p.

Contains a fair amount of technical material and as a result is probably more useful to the practicing conservator than to the layman. At the same time many practical and useful techniques are described and evaluated. Especially recommended.

CLAPP, Verner W. "The Story of Permanent/Durable Book-paper, 1115-1970." Pts. 1, 2, and 3, *Scholarly Publishing* 2, nos. 2, 3, 4, 1971: 107-24, 229-45, 353-67.

Verner Clapp, formerly Chief Assistant Librarian of Congress and president of the Council on Library Resources, though not a conservator in the customary sense of the word, was a strong, vigorous, and unusually knowledgeable supporter of conservation. In this series of three articles he has summarized, in a lucid style, the history of paper deterioration and the search for a more permanent paper for book publishing. A fine survey of the subject.

COCKERELL, Douglas. *Bookbinding and the Care of Books*, 5th ed., London, Pitman, 1955. 345 p. Out of print.

This is the classic work on hand binding. Part 2 discusses the injurious influences to which books are subject, proper shelving, insect pests, how to preserve old bindings, and the rebacking of books. The chapter on leather quotes generously from the *Report of the Committee on Leather Bookbinding*, published for the Society of Arts in 1905.

COCKERELL, Sydney M. *The Repairing of Books*, London, Sheppard Press, 1958. 110 p. Out of print.

Librarians and collectors will find this an interesting summary of some of the possible ways in which books can be repaired. According to the author, "it contains some 'first aid' operations that can be carried out by careful labour, but it is not a technical work on binding procedure, nor is it intended to give the impression that anyone can repair a valuable book without practical instruction and experience."

CUNHA, George Daniel Martin, and Dorothy Grant Cunha. *Conservation of Library Materials*, 2d ed., vol. 1, Metuchen, N.J., Scarecrow Press, Inc., 1971. 406 p.

A revised and expanded second edition that provides a broad treatment of conservation and restoration problems. This

edition contains a number of helpful appendixes, as well as a glossary and excellent subject and author indexes. Each chapter contains a list of references to the literature. Professional conservators will take issue with some of Cunha's recommendations, but the work remains one of the most useful publications in the field.

CUNHA, George Daniel Martin, and Dorothy Grant Cunha. *Conservation of Library Materials*, 2d ed., vol. 2, Metuchen, N.J., Scarecrow Press, Inc., 1972. 414 p.

This is a comprehensive guide to the literature of library and archival conservation and to the other areas of conservation closely associated with them. It is organized by subject to correspond with the arrangement of the text in volume 1. In addition, it includes an author index arranged alphabetically at the end of the book.

DOLLOFF, Francis W., and Roy L. Perkinson. *How To Care for Works of Art on Paper*, Boston, Museum of Fine Arts, 1971. 46 p.

This slender, paperbound publication, providing an excellent basic treatment of the subject matter, is more useful to those with limited experience than to the trained conservator.

GREATHOUSE, Glenn A., and Carl J. Wessel. *Deterioration of Materials: Causes and Preventive Techniques*, New York, Reinhold Publishing Corp., 1954. 835 p.

Although this book is now 20 years old, it has several excellent sections on museum and library materials, causes of deterioration, and methods of preventing deterioration. This volume does not cover restoration techniques as such.

HORTON, Carolyn. *Cleaning and Preserving Bindings and Related Materials*, 2d ed., Chicago, Library Technology Program, American Library Association, 1969. 87 p.

This is a practical and authoritative manual on the preservation of books and bindings. It is helpfully illustrated and contains a glossary, lists of supplies and equipment, sources of supplies, and a selected bibliography.

HUNTER, Dard. *Papermaking; the History and Technique of an Ancient Craft*, 2d ed., New York, Knopf, 1967. 611 p.

The basic text on the history and technology of paper and a must for the serious student of paper conservation.

LYDENBERG, Harry Miller, and John Archer (revised by John Alden), *The Care and Repair of Books*, 4th rev. ed., New York, R. R. Bowker Company, 1960. 122 p.

Although now partially outdated, this revised edition is a useful reference on some aspects of the care of books. There are chapters on the enemies of books, repair and mending, and the treatment of paper, vellum leather, and cloth. A comprehensive bibliography is included. Unfortunately, the authors tend to encourage the reader to attempt repairs which even a trained conservator might hesitate to touch, such as the restoration of papyrus and palm-leaf manuscripts. Because of this and the fact that some portions are outdated, readers should approach this work with a degree of critical judgment and some background knowledge.

MARWICK, Claire S. "An Historical Study of Paper Document Restoration Methods." M.A. thesis, American University, Washington, D.C. 1964. (Available in Copyflo from University Microfilms, Inc., Ann Arbor, Mich.)

This study makes useful reading for the conservator or for anyone interested in the field. Although it is not a definitive work, the author has carefully researched her subject and brought together a significant amount of heretofore scattered information.

MIDDLETON, Bernard C. *A History of English Craft Bookbinding Technique*, New York, Hafner Publishing Company, 1963. 307 p.

The classic volume in its field, Middleton's work is carefully researched, well written, and useful to anyone interested in the subject.

MIDDLETON, Bernard C. *The Restoration of Leather Bindings*, Library Technology Program Publication No. 18, Chicago, American Library Association, 1972. 201 p.

An excellent manual that describes in considerable detail the techniques of restoring leather bindings. Useful to both the expert and the novice, the volume is

highlighted by instructive illustrations and a well-selected bibliography on bookbinding, leather, and related subjects.

PLENDERLEITH, Harold James, and A. E. A. Werner. *The Conservation of Antiquities and Works of Art; Treatment, Repair, and Restoration*, 2d ed., London, Oxford University Press, 1971. 373 p.

This is a revised edition of Plenderleith's earlier book, *The Conservation of Antiquities and Works of Art*. Many of the techniques and procedures described in the earlier edition have been updated.

WATERS, Peter. *Procedures for Salvage of Water-Damaged Library Materials*, rev. ed., Washington, Library of Congress, 1975. 30 p.

This manual was first prepared in 1972, following the floods caused by hurricane Agnes. The new edition has been largely rewritten and expanded. It describes in detail procedures for salvaging water-damaged materials based on new research at the Library of Congress and on the author's experiences in the 1966 Florence and Lisbon floods, salvage operations in the 1972 fire in the Klein Law Library, Temple University, and the 1973 fire in the Military Personnel Records Center in St. Louis.

WINGER, Howard W., and Richard Daniel Smith, eds. *Deterioration and Preservation of Library Materials;* the Thirty-fourth Annual Conference of the Graduate Library School, August 4-6, 1969. Chicago, University of Chicago Press, 1970. 200 p.

This collection of papers presented at the 34th annual conference of the Graduate Library School provides a highly informative and useful survey of basic preservation problems. The conference did not consider restoration techniques but focused on the deterioration of library collections, the nature of paper, environmental problems, the manufacture of permanent book papers, and related topics. Essential background material for anyone interested in the conservation of library and archival materials.

JOURNALS

Art and Archeology Technical Abstracts.

Formerly called *IIC Abstracts*, this journal is published semiannually at the Institute of Fine Arts, New York University, for the International Institute for Conservation of Historic and Artistic Works, London. Nonmembers of IIC may subscribe. Inquiries should be addressed to: Circulation Department, AATA, c/o New York University, Conservation Center, Institute of Fine Arts, 1 East 78th Street, New York, N.Y. 10021.

Bulletin of the American Institute for Conservation of Historic and Artistic Works, Inc.

This *Bulletin*, currently published twice each year, is the official organ of the institute. One of the two issues is customarily devoted to technical papers presented at the annual meeting. The other issue contains contributions of members. Inquiries about membership may be addressed to: Arthur Beale, Membership Secretary, Conservation Department, Fogg Museum, Quincy Street, Cambridge, Mass. 02138.

Restaurator

Restaurator is an independent, international journal for the preservation of library and archival material. Unfortunately, publication dates are irregular, but the material is authoritative and useful. Orders for subscriptions should be sent to: Poul A. Christiansen, Librarian, University Library, Scientific and Medical Department, DK-2200 Copenhagen N., Denmark.

Studies in Conservation

This is the official journal of the International Institute for Conservation of Historic and Artistic Works. Published quarterly, the *Studies* include technical articles, book reviews, news notes, and letters to the editor. Most articles relate to the conservation of museum objects and paintings, but occasional articles discuss developments in the field of paper conservation. Membership inquiries may be addressed to: IIC, 608 Grand Buildings, Trafalgar Square, London, WC2N5HN, England.

Available without charge from the Library of Congress, Attn: Assistant Director for Preservation, Administrative Department, Washington, D.C. 20540.

Library of Congress / Washington
February 1975

Preservation Leaflets

Explanatory Note

This series of leaflets devoted to the conservation of books, manuscripts, prints and drawings, and other library and archival materials has been prepared by the Office of the Assistant Director for Preservation, Administrative Department, Library of Congress, in response to the many requests received each year for information on these topics. An occasional leaflet will be intended for the practicing conservator. For the most part, however, this material is intended for the individual, the librarian, or the archivist with a need for basic information on the preservation of relatively small collections but with limited background and experience in the conservation of books and documents.

In consequence, the treatment of topics covered in this series is not meant to be exhaustive. From time to time the Library will also publish more comprehensive monographs or conservation topics of interest to professional conservators. Individuals or institutions needing more technical information or those with special problems in the preservation or restoration of library or archival materials are encouraged to write to the Assistant Director for Preservation, Administrative Department, Library of Congress, Washington, D.C. 20540.

Available

1. Selected References in the Literature of Conservation
2. Environmental Protection of Books and Related Materials
3. Preserving Leather Bookbindings

Tentative Titles in Preparation

4. Protecting Manuscripts, Maps, and Other Materials in Flat Format by Polyester Encasement
5. Preservation Storage for Books and Related Materials
6. Sources of Supplies for the Conservator
7. Prevention and Treatment of Mildew in Library Materials
8. Preserving Library Materials on Exhibit
9. Controlling Insects and Rodents
10. Mounting and Matting Prints and Drawings
11. Before the Catastrophe—Preparing for Disaster
12. Basic Preservation for Photographic Materials
13. Preserving Newspapers and Newspaper Clippings
14. Surveying Library and Archival Collections

GPO 888-332

Environmental Protection of Books and Related Materials

PRESERVATION LEAFLETS

LIBRARY OF CONGRESS

Number 2

INTRODUCTION

This leaflet has been prepared in response to the many requests received each year from individuals with small collections of books or other paper artifacts which they seek to preserve for the future. The general principles set forth below apply to the preservation of books, manuscripts, maps, works of art on paper, and related materials. Of necessity, these guidelines have been abbreviated. Those wishing more detailed information, a full technical discussion, or answers to specific questions or special problems may write directly to the Assistant Director for Preservation, Administrative Department, Library of Congress, Washington, D.C. 20540.

BACKGROUND

Ordinary paper is an organic substance composed of cellulose fibers from green plants. Many plants produce fibers suitable for papermaking. Most of these fibers have been used for this purpose at some time in the past. Modern paper, however, is generally made from wood fibers. These are usually chemically purified for book papers or mechanically ground for newsprint. Fine writing papers generally contain linen or cotton fibers.

As a consequence of its organic nature, paper is always subject to deterioration if it is improperly made or stored. At the same time, under proper conditions paper may last for hundreds of years. The oldest known extant paper, which dates from about A.D. 100, was found in Western China by Sir Aurel Stein, who conducted excavations there during the early part of the 20th century.

Most early paper, particularly paper made from about the 12th to the middle of the 19th century, was strong and durable. If they have been properly stored during the intervening centuries, the majority of books published during that period are still in excellent condition. Unless they are of the type designated as permanent/durable or acid-free, most modern book papers, on the other hand, have an expected useful life of less than 50 years and will not last even this long unless housed in a proper environment. Most modern nonbook papers (bond and ledger papers, photocopy papers, onionskin, and the like) do not have a significantly longer expected life unless they are permanent/durable or acid-free.

CAUSES OF PAPER DETERIORATION

It is generally agreed by conservators and paper chemists that **the primary reason modern book papers deteriorate so rapidly is that they are acidic**—a condition brought about largely by the use of **alum-rosin compounds as sizing agents**. In the presence of atmospheric moisture the alum-rosin sizing generates sulfuric acid which acts to destroy the paper, **a reaction which is accelerated by high temperature and high humidity**.

A second factor in the deterioration of many modern papers is **the use of unpurified wood fibers** (groundwood). Such fibers are substantially weaker than those of chemically purified wood pulps. In addition, the lignins which remain in the pulp may degrade to form acids which weaken the sheet. **Paper produced from groundwood is also more subject to the deteriorative effects of light than paper made from purified pulps.** Newsprint contains mostly fibers from groundwood, and book papers often contain some percentage of these unpurified fibers. Because alum-rosin sizing and groundwood both came into common use for the manufacture of book papers about the middle of the last century, conservators, librarians, and others concerned with the problem often refer to the period from about 1850 to the present as the "era of bad paper."

Other important factors in the deterioration of paper include such **pollutants** in the atmosphere as sulfur dioxide, nitrogen dioxide, and **ozone**; **the invisible ultraviolet radiation in both sunlight and fluorescent light** and the short wavelengths of visible light; and **microorganisms (mold and bacteria)**, which usually grow best under conditions of high temperature and high humidity. In addition, insects and rodents often feed on paper and bookbindings and may cause serious damage to these materials.

In most instances, the owners of books and manuscripts can provide protection to their collections by observing the basic precautions set forth below.

Temperature and Humidity

Extensive research and a wealth of accumulated evidence show that **the lower the temperature at which it is stored, the longer paper will last.** It can be demonstrated theoretically that **for every 10°F decrease in temperature, the useful life of paper is approximately doubled.** As a result, a number of modern research libraries and archives have been designed with storage areas in which the temperature can be maintained as low as **55°F.** Few, if any, private homes or small libraries would find such low temperatures feasible or acceptable, but the principle is sound—the lower the storage temperature

the longer paper will endure, all other factors being equal. For most homes and libraries practical considerations dictate a temperature range of 68° to 75°F. In the summer, if a house is not centrally air-conditioned, a room-type air-conditioner may be used to keep the temperature at the proper level. In the winter, the thermostat in the room where books are housed should be set as low as feasible. Books should never be stored in attic areas, which, if not air-conditioned, may reach temperatures of 100° to 150°F on summer days, especially in southern and middle latitudes. Under such conditions, book paper undergoes rapid deterioration.

Humidity also has a serious effect on the life of book paper. **If too high, it hastens acid deterioration and leads to deterioration by such biological agents as mold and bacteria. If too low, the paper suffers from desiccation.** Present research indicates that most modern books (with the exception of those few which may be printed on permanent/durable or acid-free paper) will last longer if kept at a relative humidity of **40 to 50 percent. Leather bindings require a slightly more humid environment of 45 to 55 percent, while vellum or parchment materials should be stored at 50 to 60 percent. If a compromise is necessary, relative humidity should be maintained as close to 50 percent as possible.**

In some climates, maintenance of humidity in this range will require the use of a humidifier in the winter and a dehumidifier in the summer. Low winter temperatures will cause moisture condensation on the windows of a room having relative humidity in the 45 to 55 percent range. **Double-glazed (Thermopane) windows are helpful in maintaining humidity at the right level without condensation.** On unusually cold days, however, it may be necessary to accept some reduction in humidity to avoid excessive moisture on interior window surfaces.

There is some evidence that regular changes in temperature and relative humidity (cycling) can lead to a weakening of paper, as a result of internal stresses set up in the paper as it responds to these changes. There are no firm data to indicate how serious this effect may be, but Library of Congress scientists do not believe that it results in measurable damage to paper if such changes in temperature and relative humidity can be held to less than 10°F and 15 percent. It is probable that the book structure is more seriously affected by cycling than the paper, but here too the effects are probably minimal if changes can be held within the above limits. Experimental work is under way at the Library to obtain more precise data on the effect of temperature and humidity changes on paper.

Every year, the Library's Preservation Office receives a number of inquiries from persons who have suffered damage to book and manuscript collections stored in basements which have either flooded or are so humid that the materials have mildewed. Unless a basement is absolutely waterproof and "floodproof," and unless it can be maintained at a relative humidity of less than 60 percent, it should not be used for the storage of valuable books and documents.

Rare book collectors who wish to maintain the best possible environmental conditions may want to invest in a hygrothermograph which provides a continuous record of temperature and humidity. Several sources of hygrothermographs are listed at the end of this leaflet. Others may wish to have an accurate, inexpensive instrument which does not produce a record but does indicate both temperature and humidity. The only economical and reasonably reliable device of this type known to the Preservation Office is the Edney "Thermo-Hygrometer." The address of the supplier of this equipment is also shown below.

Mold

Mold or mildew attacks on books can occur when both temperature and humidity are uncontrolled. Mold spores are always present in the air and on books. These spores may begin to grow when the temperature is above 80°F, the relative humidity is above 70 percent, and the air is stagnant or nearly so. Some molds can grow at temperatures as low as 40°F if the humidity is right. In cases where severe mold growth has been experienced and the area has not been thoroughly fumigated, mold growth can start again at temperatures and humidities below what are generally considered the threshhold limits. Mold prevention requires that *both* temperature and humidity be kept within the range suggested above.

Initially mold may be only a nuisance. If detected before growth has become advanced, the visible evidence of mold (usually the spores) can be brushed away quite readily. When mold is first observed in library materials, immediate action should be taken to change the environmental conditions so that it cannot continue to propagate. This may be accomplished by lowering the temperature and humidity. If mold growth is already well advanced the entire book collection and the area in which it is housed will require fumigation. Unless these steps are taken promptly the mold will digest the material upon which it has begun to grow. This results not only in the staining and deterioration of the materials involved but in a rapid loss in strength of the paper.

Mold can be very difficult to bring under control and serious damage is often caused before it is detected. As in so many instances, prevention is easier than correction, and it will pay the collector, the librarian, or the curator to monitor the environment so that conditions favorable to mold growth do not occur. Treatment of mold infestations which occur when temperature and humidity have been permitted to get out of bounds is the subject of another leaflet in this series.

Atmospheric Pollutants

Such gases as sulfur dioxide, hydrogen sulfide, and nitrogen dioxide are often major factors in the deterioration of paper. They originate from the burning of fossil fuels or other combustion or chemical processes such as occur in furnaces, automobiles, power plants, and the like and thus are most serious in industrial and urban areas. However, they are difficult to combat anywhere. No economical means of protection are possible in the ordinary home or small library. If it is desired to remove these pollutants from the air supply of libraries, archives, and museums the intake air must be passed through treatment beds incorporated in the air-handling equipment, where special chemicals adsorb the pollutant gases. Certain compounds are not so dangerous in themselves but cause damage to paper because of their tendency to combine with atmospheric moisture to form acids. Thus, SO_2 is catalyzed by other compounds in the air into SO_3, which then unites with water vapor to form sulfuric acid.

Ozone, another atmospheric pollutant, also causes the oxidation and consequent embrittlement of paper. This gas is often found in the air after thunderstorms and is generated by the interaction of sunlight and nitrogen dioxide from automobile exhaust. A prominent constituent of smog, ozone is also produced by electrostatic filtering systems, sometimes used ignorantly by architects and engineers in the air-conditioning of libraries, archives, and museums and less frequently in residential air-conditioning systems.

Dirt and dust particles in the air not only carry with them the adsorbed pollu-

tants mentioned above but may exert an abrasive action on books and papers. Thus, **keeping clean filters in the air-conditioning system is an important responsibility** of the custodian, whether he be private collector or librarian.

Light

The ultraviolet rays in sunlight and fluorescent light promote the oxidation of cellulose and, therefore, can cause rapid and serious deterioration in paper.

Although the deterioration caused by visible light is less severe than that caused by the invisible ultraviolet, it too can cause damage to paper, leather, and fabrics. The rays at the blue end of the visible spectrum are more damaging than those at the red end. Light has two effects on paper, both of which result in its ultimate embrittlement and deterioration. First, it has a bleaching action and this causes some whitening of paper and the fading of colored papers and certain inks. Second, it causes any lignins which may be present in the paper to react with other compounds and turns it yellow or brownish. It is this reaction which results in newspapers' turning yellow on exposure to light. At the same time these visible effects of light are taking place, certain invisible changes also occur. Fibers in the paper are broken into smaller and smaller units until they are so short they can no longer maintain the bonds necessary to hold the paper together. Unfortunately, the reactions initiated by light continue after the source of damage has been removed.

All of this means that paper will last far longer in the dark (other factors being equal) than in the light. Storing book collections in the dark is seldom practical. However, suitable precautions may include storage out of direct sunlight, the use of special ultraviolet filtering materials over fluorescent tubes or windows, or the use of heavy draperies. The use of fluorescent lights is usually limited in the home, so this source of ultraviolet is not likely to be a problem there. Where these damaging rays need to be filtered out of sunlight, UF-3 Plexiglas or Acrylite OP-2 is available as a substitute for regular window glass, or these materials may be taped or otherwise fastened over existing window glass.

Valuable manuscripts and similar paper documents such as old deeds, military commissions, diplomas, and the like require similar protection if they are to last. Preferably, these materials should be kept in acid-free file folders in the dark. If possible they should be deacidified and alkaline buffered by a competent paper conservator before storage. However, in those instances where it is desired to display a particular item, it should be cleaned and repaired as necessary and then deacidified, buffered, and framed under UF-3 Plexiglas or Acrylite OP-2. These protective materials should never be in direct contact with the document, however, since the yellow dye used to filter out the UV will discolor the paper. Competent framers are usually prepared to mount and mat documents with acid-free board. The mat separates the document from the plastic.

Even when so protected, documents should not be hung where they are exposed to strong light from the out-of-doors or to fluorescent light.

Exhibit cases are generally provided with fluorescent lights which emit heavily in the ultraviolet region and thus may cause severe damage to books, manuscripts, and other paper materials unless measures are taken to filter out the damaging rays. For this purpose special filters made of UF-3 or Acrylite OP-2 in the form of sleeves which slip over standard fluorescent tubes are available. Under some conditions it may be preferable to use the plastic filtering material in sheet form.

Insects and Rodents

Books contain the cellulose of paper, as well as proteins or carbohydrates in the form of gelatin sizing, glue, paste, leather, and other organic substances attractive to insects and to rodents. The surest way to avoid insect and rodent problems in temperate latitudes is to follow ordinary good housekeeping practices. This means, for example, that food should be kept out of the library or room housing the collection. Windows should be screened, and any insects observed should be killed. If evidence of rodents is observed, trapping or poisoning may be required.

As a further precaution against insect attack, small open containers (saucers, can lids, etc.) of paradichlorobenzene should be placed on shelves or in bookcases. Note, however, that this material eventually volatilizes and will need to be replenished. Since this compound is poisonous, it should not be used where there may be young children.

In semitropical areas, such as Florida and the Gulf Coast, insects are usually a more serious problem than father north. Here too, good housekeeping practices and constant vigilance will help the book collector and small library avoid insect infestations.

RECOMMENDED REFERENCES

BANKS, Paul N. "Environmental Standards for Storage of Books and Manuscripts," *Library Journal* 99, no. 3 (February 1, 1974): 339-343.

CUNHA, George Daniel Martin, and Dorothy Grant Cunha. *Conservation of Library Materials*, 2d ed., vol. 1 (vol. 2 is a bibliography), Metuchen, N.J., Scarecrow Press, Inc., 1971. 406 p.

WINGER, Howard W., and Richard Daniel Smith, eds. *Deterioration and Preservation of Library Materials;* the Thirty-fourth Annual Conference of the Graduate Library School, August 4-6, 1969. Chicago, University of Chicago Press, 1970. 200 p.

SOURCES OF SUPPLIES

Hygrothermographs and Thermo-Hygrometers

Several excellent instruments are available directly from manufacturers or suppliers of scientific instruments. Those known to the Preservation Office are:

Abbeon Cal, Inc.
123 Gray Avenue
Santa Barbara, Calif. 93101

Belfort Instrument Co.
1600 South Clinton Street
Baltimore, Md. 21224

Edney A.27F Direct Reading
Thermo-Hygrometer
Pastorelli and Rapkin Ltd.
Viking House
5-11 Worship Street
London E.C. 2
United Kingdom

Gulton Industries, Inc.
Gulton Industrial Park
East Greenwich, R.I. 02818

Weather Measure Corporation
P.O. Box 41257
Sacramento, Calif. 95841

Mounting and matting board, acid-free

Hollinger Corporation
3810 South Four-Mile Run Drive
Arlington, Va. 22206

Process Materials Corporation
329 Veterans Boulevard
Carlstadt, N.J. 07072

UF-3 Plexiglas and Acrylite OP-2

Available in tube or sheet form from local plastic suppliers. Consult the Yellow Pages.

Available without charge from the Library of Congress, Attn: Assistant Director for Preservation, Administrative Department, Washington, D.C. 20540.

Library of Congress / Washington
February 1975

Preservation Leaflets

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In consequence, the treatment of topics covered in this series is not meant to be exhaustive. From time to time the Library will also publish more comprehensive monographs or conservation topics of interest to professional conservators. Individuals or institutions needing more technical information or those with special problems in the preservation or restoration of library or archival materials are encouraged to write to the Assistant Director for Preservation, Administrative Department, Library of Congress, Washington, D.C. 20540.

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4. Protecting Manuscripts, Maps, and Other Materials in Flat Format by Polyester Encasement
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11. Before the Catastrophe—Preparing for Disaster
12. Basic Preservation for Photographic Materials
13. Preserving Newspapers and Newspaper Clippings
14. Surveying Library and Archival Collections

GPO 889-085